



EAST Browser - L35 (25) phase new3 | US 5440269 | Title: S | Doc: 50/126 | "Full" 1/12 (Total images 12) | Front Page

US PATENT

DOCUMENT IDENTIFIER

TITLE: Digital FM demodulator

— KWIC —

TITLE - TO (1): Digital FM demodulator

Brief Summary Text of Frequency demodulation carried out as follows:

Brief Summary Text of An input signal in the 12, which delays the by simultaneously, a first predetermined time, a cosine wave, i.e., the phase shifter 12 is out, delay 14. A magnitude value of the sine wave (absolute value of the  $\alpha$  comparison, if the absolute value of the sine wave signal, as an address a sine wave, the cotangent 40 reads out and outputs from divider 14.

Brief Summary Text of (a) generating a delay

United States Patent [9]

[11] Patent Number: 5,440,269

[45] Date of Patent: Aug. 8, 1995

Hwang

[34] DIGITAL FM DEMODULATOR HAVING AN ADDRESS CIRCUIT FOR A LOOKUP TABLE

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[73] Assignee: Samsung Electronics Co., Ltd., Kyungki-do, Rep. of Korea

[21] Appl. No.: 303,212

[22] Filed: Sep. 8, 1994

[30] Foreign Application Priority Data  
Sep. 8, 1993 (KOR) Rep. of Korea 93-19014

[51] Int. Cl.<sup>6</sup> H03D 3/02

[52] U.S. Cl. 329/334; 329/341; 375/214; 455/214

[58] Field of Search 329/318, 329, 334, 341, 329/342, 343, 375/20, 455/214

References Cited

U.S. PATENT DOCUMENTS

4,862,099 12/1989 Patel et al. 329/341

4,994,754 2/1991 Chen 329/312

Primary Examiner—Stephen H. Ortmann  
Attorney, Agent, or Firm—Sughrue, Mion, Zinn, Macpeak & Seas

ABSTRACT

In a digital frequency demodulator, data representing the input signal to be demodulated is prestored in a look-up table and signal processing is digitally performed to generate a read address required for reading out the data stored in the look-up table using a phase shift method of operation. Phase-shifting is performed by determining the slope of a frequency-modulated signal containing a signal which does not cross the zero axis. Thus, the precision of the frequency demodulation is enhanced, and the frequency demodulation data stored in the look-up table is minimized to reduce the size of a ROM used for the look-up table. The digital frequency demodulator includes a look-up table for storing frequency demodulation data, an address generating circuit for comparing the magnitude of the absolute value of frequency modulated signal and a phase-shifted version thereof so as to generate address information for the look-up table and a comparison signal, a circuit for determining the slopes of the frequency-modulated and phase-shifted signals and, responsive thereto, generating slope determination signals, and a phase compensator for operating on the output from the look-up table in response to the slope determination signals and the comparison signal to thereby expand the phase value output from the look-up table. A method for operating a digital frequency demodulator is also revealed.

15 Claims, 5 Drawing Sheets

INPUT SIGNAL

101 DELAY

102 PHASE SHIFTER

103 1ST ABSOLUTE VALUE PROCESSOR

104 2ND ABSOLUTE VALUE PROCESSOR

105 T<sub>1</sub>

106 T<sub>2</sub>

107 ADDER

108 LOOKUP TABLE

109

110

CASI Browser - 1.43 (2) ("4862099") | US 4862099 | Tag: G | Doc: 2/2 | "Full" 1/8 (Total images: 8) | Front Page

United States Patent (19) Patent Number: 4,862,099  
Nakai et al. (42) Date of Patent: Aug. 23, 1989

(54) DIGITAL FM DEMODULATOR WITH DISTORTION CORRECTION  
(75) Inventors: Takahiro Nakai, Kazuo Yamashita, Yasuhiko Shimizu, all of Nagasaki, Japan  
(73) Assignee: Mitsubishi Denki Kabushiki Kaisha, Tokyo, Japan  
(21) Appl. No.: 333,543  
(22) Filed: Aug. 17, 1989  
(23) Foreign Application Priority Data: Aug. 18, 1987 (JP) 63-30317  
(51) Int. Cl. H03D 1/00  
(52) U.S. Cl. 328/124, 328/143, 328/225, 328/120, 328/125, 340/70  
(53) Field of Search: 328/124, 328/125, 328/126, 328/143, 328/225, 340/70, 340/75  
(54) Reference Cited  
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4,853,039 6/89 Morimoto  
OTHER PUBLICATIONS  
"Experiments on VTR Digital Signal Processing" K. Nakai, 2 Drawing Sheets

(57) ABSTRACT  
A frequency demodulator includes an analog-to-digital converter for converting an inputted FM signal into a digital signal. A 90° phase shifter is used to phase shift the converted digital signal. The phase shifted signal and the converted signal are utilized to calculate the results of the  $\cos^2(Y)$ . X represents the converted signal, and Y represents the phase shifted signal. The results from the calculation is delayed for a period of time equal to one sampling cycle. The frequency demodulator also includes a subtractor for subtracting the delayed signal from the calculation result. A discontinuity correction circuit corrects any discontinuity in an output from the subtractor, and a reversal phenomenon compensator compensates the output from the discontinuity corrector when the output from the discontinuity corrector exceeds a predetermined range of levels. These levels correspond to an opposition of discrete lines of black or white color as a reproduced picture.

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**Detailed Description** FIG. 2 shows a fundamental demodulating apparatus

**Detailed Description**  
As shown in FIG. 2, it supplied an FM-modulated signal to the input of the filter 10. The FM-modulated signal was supplied through a delay circuit 11. Further, the signal was supplied through a transmission limiter 12a to a second filter 14 functions as a Hilbert transform circuit. Furthermore, the first and second pulse count type FM-de-

**Detailed Description To**  
An arrangement of the  
described more fully w

Detailed Description T Referring to FIG. 2, an is directly supplied to o also supplied through a exclusive-OR circuit 13 13c is fed to an output

**Detailed Description**  
The FM-demodulating  
when an FM-modulated  
13b, the exclusive-OR g  
input signal and a sign  
Thus, a pulse signal wh  
output terminal 13c.

## United States Patent [57]

(11) Patent Number: 5,119,199

(45) Date of Patent: Jun. 2, 1992

Sakamoto

(M) FM DEMODULATOR FOR VIDEO TAPE RECORDER

FOREIGN PATENT DOCUMENTS

65-118206 6/1967 Japan.

*Primary Examiner—James J. Grady*  
*Assistant Examiner—Jeffrey S. Merrill*  
*America Agent or Firm—Jill, Van Santen, Broadman & Simpson*

[57] **ABSTRACT**

As input for receiving FM modulated video signals is connected to a first demodulator circuit, the output of which is connected to the first input of an adder. The input is also connected to a transversal filter, the output of which feeds a Hilbert transform circuit that has two outputs connected to a second demodulator circuit. The output of the second demodulator is connected to a second input of the adder. The adder providing an FM demodulated video signal with reduced noise and improved signal-to-noise ratio. In a second embodiment, the Hilbert transform circuit is formed by delay circuits and phase shifters. The output of the first delay circuit is connected to the input of the second delay circuit. The output of the second delay circuit is connected to the input of the adder. The adder is connected to add the output of the delay circuits to the input thereof. First and second demodulators receive the outputs from the subtractor and adder, respectively. The outputs of the subtractor and adder are connected to the input to produce the FM demodulated video signal.

4 Coins, 4 Drawing Sheets

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